

*AN ANALYSIS OF CHOICE MAKING IN  
THE ASSESSMENT OF YOUNG CHILDREN WITH  
SEVERE BEHAVIOR PROBLEMS*

JAY W. HARDING, DAVID P. WACKER, WENDY K. BERG,  
LINDA J. COOPER, JENNIFER ASMUS,  
KISA MLELA, AND JESSICA MULLER

THE UNIVERSITY OF IOWA

We examined how positive and negative reinforcement influenced time allocation, occurrence of problem behavior, and completion of parent instructions during a concurrent choice assessment with 2 preschool-aged children who displayed severe problem behavior in their homes. The children were given a series of concurrent choice options that varied availability of parent attention, access to preferred toys, and presentation of parent instructions. The results showed that both children consistently allocated their time to choice areas that included parent attention when no instructions were presented. When parent attention choice areas included the presentation of instructions, the children displayed differential patterns of behavior that appeared to be influenced by the presence or absence of preferred toys. The results extended previous applications of reinforcer assessment procedures by analyzing the relative influence of both positive and negative reinforcement within a concurrent-operants paradigm.

DESCRIPTORS: choice making, preschool children, problem behavior

A number of applied investigations have evaluated the variables that influence choice with the goal of achieving better clinical outcomes in the reduction of problematic behavior (Fisher & Mazur, 1997). These studies have used a concurrent-operants arrangement in which two or more behaviors are concurrently available and each is correlated with an independent schedule of reinforcement. For example, investigators have examined various reinforcement dimensions (e.g., reinforcement rate, delay, and quality) to determine whether they have similar ef-

fects in natural settings (e.g., Mace, Neef, Shade, & Mauro, 1994; Neef, Mace, & Shade, 1993; Neef, Shade, & Miller, 1994). As discussed by Neef et al. (1994), response alternatives in natural contexts are often asymmetrical across reinforcer dimensions. For example, an investigation by Neef et al. (1993) with students diagnosed as seriously emotionally disturbed showed that delays to reinforcement produced a bias toward the response alternative (choice) that provided more immediate access to reinforcement. A subsequent study by Neef et al. (1994) evaluated how specified reinforcer dimensions combined to influence the time allocated to two concurrent sets of math problems for youths with learning and behavior difficulties. The results showed that student responding was differentially affected by systematic changes in reinforcer and response dimensions.

A second area of investigation on choice making used concurrent stimulus presentations as a means of generating hypotheses

---

This research was supported by Grant R01-HD 29402 from the National Institutes of Child Health and Human Development of the National Institutes of Health. The opinions expressed herein do not necessarily reflect the position or policy of that agency. The authors express their appreciation to the families who participated in this study. We also express our appreciation to Agnes DeRaad, Barbara Rankin, and Anjali Barretto for manuscript preparation.

Jennifer Asmus is now at the University of Florida.

Address correspondence and requests for reprints to Jay Harding, University Hospital School, Room 251, 100 Hawkins Drive, The University of Iowa, Iowa City, Iowa 52242.

regarding the reinforcing properties of specific stimuli in the individual's environment (e.g., Derby *et al.*, 1995; Fisher *et al.*, 1992; Piazza, Fisher, Hagopian, Bowman, & Toole, 1996; Sigafoos & Dempsey, 1992; Smith, Iwata, & Shore, 1995). Reinforcer assessment procedures that provide choices among stimuli are considered to approximate natural contexts in which individuals have an opportunity to select between concurrently available items or activities (Northrup, George, Jones, Broussard, & Vollmer, 1996). For example, Fisher *et al.* (1992) demonstrated that a forced-choice procedure resulted in more accurate identification of reinforcers than presenting single stimuli (e.g., Pace, Ivancic, Edwards, Iwata, & Page, 1985). Piazza *et al.* (1996) further demonstrated that the relative preference for stimuli displayed by individuals during choice assessments could be used to predict the relative reinforcing value of those same stimuli. Thus, choice among concurrently available stimuli appears to have great potential as a reinforcer assessment procedure. The key, perhaps, is that concurrently available stimuli force the individual to demonstrate, via making choices, a relative preference between stimuli rather than to indicate a relative preference between any given stimulus versus nothing at all.

Researchers have also used concurrent-operants arrangements within clinical intervention procedures to reduce aberrant behavior (e.g., Horner & Day, 1991; Peck *et al.*, 1996; Piazza *et al.*, 1997). For example, Peck *et al.* showed that the presentation of concurrent choices was useful for designing highly specific treatment packages for young children who engaged in aberrant behavior. Following an experimental analysis of maintaining contingencies, the investigators demonstrated that both choice making and aberrant behavior could be influenced by altering one or more dimensions of reinforcement (e.g., amount and quality). For 1

child, Peck *et al.* showed similar findings with negative reinforcement (e.g., duration of break from demands) as well as with positive reinforcement, thus demonstrating that both positive and negative reinforcement could be studied within a concurrent-operants paradigm.

Although the use of concurrent-operants arrangements has proven useful in the identification of specific dimensions of reinforcement that increase specific behaviors, treatment programs may initially require reductive procedures (e.g., extinction or punishment) to reduce inappropriate behaviors to acceptable levels (Fisher *et al.*, 1993; Wacker *et al.*, 1990). Previous investigations have evaluated the efficacy of extinction procedures in the reduction of aberrant behavior (Lerman & Iwata, 1996). The use of extinction has been associated with a number of behavioral patterns including a temporary increase in response frequency (Iwata, Pace, Kalsher, Cowdery, & Cataldo, 1990) and extinction-induced aggression (Goh & Iwata, 1994). On a practical level, then, extinction procedures may be difficult or even dangerous to implement (Peck *et al.*, 1996). Evaluating the influence of positive reinforcement on escape-maintained problem behavior has been suggested as a means of identifying conditions in which individuals are more likely to engage in adaptive behavior (Zarcone, Fisher, & Piazza, 1996) without having to rely on reductive techniques and the negative side effects that may accompany those techniques.

Peck *et al.* (1996) suggested that the use of a concurrent-operants paradigm may reduce the need for extinction procedures by biasing child behavior to alternatives that provide either a higher quality or a greater amount of reinforcement. Piazza *et al.* (1997) evaluated the effects of reinforcing compliance with combinations of positive reinforcement (tangible items, attention) and negative reinforcement (break from de-

mands) when problem behavior produced a break versus when it was placed on extinction. For 2 of the children, compliance increased when it produced contingent access to preferred items, even though problem behavior resulted in a break from demands. Thus, within a concurrent-operants arrangement, increasing the reinforcement for an appropriate behavior (e.g., compliance) may increase the likelihood of that behavior over an alternative, inappropriate behavior. However, investigators in that study also reported that as the schedule of reinforcement for compliance was thinned, it was necessary to add escape extinction to the treatment program.

The primary purpose of the current investigation was to evaluate the relative influence of positive and negative reinforcement on choice making with 2 children who displayed escape-maintained problem behavior. On a conceptual level, the concurrent-operants methodology was used to evaluate the effects of different types and dimensions of reinforcers on various aspects of behavior. A concurrent-operants assessment was used to evaluate time allocation between concurrent choice options that included combinations of access to parent attention and preferred toys and escape from parent instructions. On a clinical level, we examined relationships between the child's selection of concurrently available choice options and compliance to parent instructions. Our objective was to determine whether the manipulation of concurrently available reinforcers during the choice assessment would result in increased compliance without the use of escape extinction procedures.

## METHOD

### *Participants and Settings*

Two children who were participants in a federally funded research project (Wacker & Berg, 1992) were included in the study.

Both children had been referred to the project by local area education agency in-home interventionists for severe behavior problems. The only criterion for inclusion in the current investigation was the display of aberrant behavior maintained by negative reinforcement during in-home observations. Susan, aged 4 years 3 months, had been diagnosed with autism and developmental delays. Problem behaviors included aggression (hitting, kicking), self-injury (placing fingers and objects on eyes), and noncompliance. Kyle, aged 4 years 3 months, had been diagnosed with a behavior disorder. Problem behaviors included aggression (hitting), self-injury (head slapping), property destruction, and noncompliance. Both Susan and Kyle communicated verbally in complete sentences. Both children attended early childhood special education programs in their respective communities. All assessment and treatment sessions were conducted in the living room of the children's homes. The children's mothers served as therapists, with coaching from the first author, during all assessment and treatment probe sessions. All sessions were videotaped for subsequent data collection and analysis.

### *Response Definitions*

A 6-s partial-interval recording system was used to measure child and parent behaviors. Six categories of child behavior were recorded. *Toy engagement* was defined as appropriate physical contact with a toy. *Time allocation* was defined as the child's physical presence in one of two concurrent choice areas available in each choice condition. *Destructive behaviors* were defined as any aberrant behavior and included self-injury, aggression, and property destruction. *Disruptive behaviors* were defined as behaviors that precluded task completion but were not destructive and included task refusal, crying, and screaming. For the purpose of this investigation, percentage of intervals with both

destructive and disruptive behavior were combined and labeled as problem behavior. *Appropriate behaviors* were defined as active engagement in required tasks and independent play. *Social interactions* were defined as appropriate vocal and nonvocal exchanges between child and parent. Vocal interactions included any verbal utterance (words, babbling, laughing) directed toward the parent or in response to a parent question. Nonvocal interactions included touching the parent, gesturing toward the parent, and concurrent physical contact with an item with the parent. For the purpose of this investigation, percentage of intervals with both vocal and nonvocal exchanges were combined and labeled as social interactions.

Parent task instructions and child task completion data were recorded using an event-recording system. *Parent task instructions* were listed verbatim in the order of occurrence. *Child task completion* of each task was then recorded as (a) task completed independently (no physical assistance from parent), (b) task completed with parent assistance (parent provided hand-over-hand guidance), or (c) task not completed.

#### *Interobserver Agreement*

Trained data collectors independently scored the ongoing occurrence of toy engagement (preference assessment only) and all behaviors (except parent instructions and child task completion) from the videotapes using a 6-s partial-interval recording system. Interobserver agreement on occurrence was calculated based on exact interval-by-interval comparisons in which the number of agreements was divided by the number of agreements plus disagreements and multiplied by 100%. Interobserver agreement for toy engagement was assessed for 48% of sessions across both children. Interobserver agreement for toy engagement ranged from 92% to 100% ( $M = 99\%$ ). Interobserver agreement for occurrence of child behavior was

assessed for 41% of sessions across both children and ranged from 90% to 100% ( $M = 98\%$ ).

For occurrence of parent task instructions and child task completion, interobserver agreement was assessed by having two observers independently collect occurrence data from the videotapes across 100% of sessions. An event-by-event recording procedure was used, and interobserver agreement was calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100%. Interobserver agreement for parent task instructions ranged from 90% to 100% ( $M = 99\%$ ). Interobserver agreement for child task completion ranged from 90% to 100% ( $M = 99\%$ ).

#### *Experimental Design*

The study was conducted in four phases: (a) a preference assessment to identify highly preferred and less preferred toys, (b) a functional analysis to identify the role of positive and negative reinforcement in maintaining problem behavior, (c) a choice assessment to evaluate the effects of positive and negative reinforcement on time allocation, and (d) follow-up probes to evaluate the effects of a treatment program designed for each child based on the results of the three assessment procedures.

In Phase 1, a multiple schedule design was used to evaluate relative preferences across the group of toys identified as preferred by each child's parent. A multielement design was conducted during Phase 2 to identify the roles of positive and negative reinforcement in maintaining problem behavior within a functional analysis. Three conditions (free play, contingent attention, and contingent escape) were manipulated using the methodology described by Iwata, Dorsey, Slifer, Bauman, and Richman (1982/1994). In Phase 3, a concurrent-schedules design (Browning, 1967) was used to evaluate the

role of positive reinforcement on time allocation across the first two choice conditions. A concurrent-schedules design was combined with a reversal design to evaluate the effects of positive versus negative reinforcement on time allocation for the final three choice conditions in Phase 3. The stimuli available in each choice area during Choice Conditions 1 through 5 are presented in Table 1. During Phase 4, follow-up probes were conducted to evaluate treatment outcomes.

#### *Procedure*

*Phase 1: Preference assessment.* Parents listed toys that were available to the child in the home and rated each toy as either preferred (P) or nonpreferred. Parent-identified preferred toys for Kyle consisted of crayon-and-paper activities, puzzles, memory game, and books. Preferred toys for Susan consisted of Legos®, a shovel, an educational game, plastic eggs, and plastic jewels. A direct assessment of these parent-identified toys was conducted to identify empirically the toy that was most preferred by each child based on the procedures of Windsor, Piche, and Locke (1994). At the beginning of each session, all toys were grouped together within easy reach of the child, and the child was told to play with any of the toys. All toys remained available throughout the session, and no restrictions were placed on the length of time spent with a toy. The parent provided continuous attention in the form of playing and social interactions throughout each 5-min preference assessment session. Data were collected on the percentage of intervals in which the child was engaged with each toy. The toy that was engaged for the largest number of intervals was identified as the highly preferred toy (HP) and the remaining toys were identified as less preferred (LP).

Parents also selected four common household objects to establish a pool of neutral (N) items for Choice Conditions 1 and 2.

Our objective in including neutral objects was to provide as clear a contrast as possible between toys that were identified as being preferred in Phase 1 and objects that had no history of reinforcement. Neutral objects for Kyle consisted of a potholder, plastic container, dish towel, and spoons. Neutral objects for Susan consisted of a potholder, plastic container, rolling pin, and potato masher.

Preference assessment probes were repeated throughout the choice assessment (an additional seven sessions for Kyle and three sessions for Susan) to verify the stability of the previously identified highly preferred toy. During Choice Conditions 3, 4, and 5, the highly preferred toy choice areas always included the toy that was identified as highly preferred during the preference assessment (Legos® for Susan, crayon-and-paper activities for Kyle). The less preferred toy choice area always included a toy that was never selected during preference assessment sessions (educational game for Susan, memory game for Kyle).

*Phase 2: Functional analysis.* During the functional analysis (Iwata et al., 1982/1994), three assessment conditions were conducted to identify maintaining events for problem behavior. During the free-play (control) condition, parents allowed the child access to all preferred toys, provided continuous attention (play and social interaction), ignored minor inappropriate behavior, and neutrally blocked any potentially destructive behavior. During the contingent attention condition, the child had access to all preferred toys, but parents ignored the child unless he or she engaged in problem behavior. Parents blocked any potentially destructive behavior and provided brief attention (6 to 10 s) in the form of mild reprimands (e.g., "Don't do that"). During the contingent escape condition, parents directed the child to work on an educational task by stating a specific instruction (e.g., "Put the red Lego® on the green Lego®") approximately every 20 s. For



Table 1  
Choice Assessment Conditions

Choice conditions	Concurrent choice options	Hypotheses
Condition 1	Choice Area A Attention/P: attention + preferred toys	Attention, preferred toys, or both, maintain choice
	Choice Area B Alone/N: alone + neutral items	Escape from parent maintains choice
Condition 2	Choice Area A Attention/N: attention + neutral items	Attention maintains choice
	Choice Area B Alone/P: alone + preferred toys	Preferred toys, escape from parent, or both, maintain choice
Condition 3	Choice Area A I/HP: attention with instructions + highly preferred toy	Attention, highly preferred toy, or both, maintain choice
	Choice Area B Alone/LP: alone + less preferred toys	Escape from instructions maintains choice
Condition 4	Choice Area A I/LP: attention with instructions + less preferred toys	Attention maintains choice
	Choice Area B Alone/HP: alone + highly preferred toy	Escape from instruction, access to highly preferred toy, or both, maintain choice
Condition 5	Choice Area A I/HP: attention with instructions + highly preferred toy	Attention, highly preferred toy, or both, maintain choice
	Choice Area B Alone/HP: alone + highly preferred toy	Escape from instructions, highly preferred toy, or both, maintain choice

Susan, task instructions consisted of manipulating parent-selected game pieces. For Kyle, task instructions consisted of tracing parent-selected numbers and letters on a worksheet. Occurrences of problem behavior resulted in the removal of the task for about 20 s, and the child was allowed to play with other available toys in his or her own fashion. Two to five sessions of each condition were conducted, conditions were counter-balanced across sessions, and sessions were 5 min in duration.

*Phase 3: Choice assessment.* During the choice assessment, which consisted of five

separate conditions, the living room was divided into equal halves by placing a strip of masking tape down the center of the room to create two choice areas. Throughout each session of all five choice conditions, the child had the option of interacting with stimuli in either of two choice areas. One of these areas always included the child's parent. Options within each choice condition were counter-balanced across both sides of the living room during all assessment sessions. The choice conditions were presented in the sequence 3, 4, 3, 4, and 3 for Susan and 3, 4, 3, 5, and 4 for Kyle.

Prior to each session, the child was directed to the tape at the center of the room and received brief instruction from the first author (e.g., "You have a choice. You can play with Mom on this side, or you can play by yourself on this side."). At all times during each session, the child was allowed to move freely across both choice areas. If the child picked up a toy from one side and carried it across the line, the first author replaced it and told the child, "This stays over here." If the child attempted to leave the choice assessment area (living room), he or she was returned to the area by the first author and the choice options were repeated. Each choice assessment condition was conducted over at least 2 days, with the exception of the final replication of Choice Condition 3 and Choice Condition 4 in Susan's assessment, which were each conducted during 1 day. Sessions were 5 min in duration.

Parent attention, in the form of playing and social interaction, and access to preferred toys were compared as reinforcers in Choice Conditions 1 and 2. During Choice Condition 1 (attention/P vs. alone/N), the child was given the choice of parent attention and preferred toys (P) on one side of the living room and playing alone with neutral items (N) on the other side of the living room. We hypothesized that if positive reinforcement controlled choice, the child would spend most of the time on the side of the room where parent attention and preferred toys were available (attention/P). If choice was controlled by negative reinforcement (avoidance of parent), then the child would allocate his or her time to the side of the room where no parent attention was provided and neutral items were available (alone/N).

Parent attention and preferred toys were separated for Choice Condition 2 (attention/N vs. alone/P) to determine which stimulus controlled choice. The child was given the choice of parent attention and

neutral items on one side of the living room or playing alone with the pool of preferred toys on the other side of the living room. We hypothesized that if parent attention was a higher quality reinforcer than preferred toys, the child would allocate more time to the side of the room where parent attention was available with neutral items (attention/N). If preferred toys were a higher quality reinforcer, then the child would allocate more time to the side of the room that contained the preferred toys without parent attention (alone/P).

Task instructions were added to the positive reinforcement choice conditions for Choice Conditions 3, 4, and 5 to evaluate the effects of negative versus positive reinforcers on time allocation. Instructions (I) during Choice Conditions 3, 4, and 5 consisted of the parent directing the child's play by stating a specific task instruction approximately every 30 s. If the child complied with the instruction, the child continued to receive parent attention and was allowed 30 s of free play until the next instruction. Thus, each completed task was followed by free play until the next instruction. If the child did not comply with the instruction, the parent repeated it every 10 to 20 s as long as the child remained in the attention with instructions choice area. If the child left the attention with instructions choice area, the instruction stopped. If the child returned, the parent repeated the previous instruction until the child complied or the session was discontinued. Thus, the child could escape parent instructions at any time by leaving the attention with instructions choice area.

During Choice Condition 3 (I/HP vs. alone/LP), the child was given the choice of parent attention and task instructions with the toy identified as highly preferred during the preference assessment or playing with less preferred toys without parent attention. Thus, the child still had access to toys, but

not to the most preferred toy if he or she chose to play alone. We hypothesized that if positive reinforcement (attention, highly preferred toy, or both) controlled time allocation, then the child would remain in the area with the parent even though task instructions were presented. Conversely, if negative reinforcement controlled time allocation, the child would select the side of the room that allowed him or her to avoid parent instructions.

During Choice Condition 4 (I/LP vs. alone/HP), the less preferred toys were now placed on the same side of the living room with the parent and the highly preferred toy was placed on the other side of the room. As in Choice Condition 3, the parent presented task instructions every 30 s to the child as long as he or she remained on the side on which attention was available (I/LP). We hypothesized that if parent attention controlled time allocation, then the child would select the choice area in which attention was available even though the parent delivered task instructions with less preferred toys. Conversely, if negative reinforcement or access to the highly preferred toy controlled time allocation, then the child would select the choice area in which he or she had access to the highly preferred toy (alone/HP).

Choice Condition 5 (I/HP vs. alone/HP) was conducted only for Kyle. In this condition Kyle had the option of selecting the choice area that contained his parent and task instructions with a highly preferred toy (crayon-and-paper activities) or the area with the same highly preferred toy and no parent attention or instructions. We included this condition for Kyle because the results of Choice Conditions 3 and 4 suggested that time allocation was controlled by parent attention, but compliance with task instructions was variable when instructions were associated with a highly preferred toy. We hypothesized that if parent attention was sufficiently rein-

forcing, then positive reinforcement should maintain Kyle's time allocation to the side of the room that enabled him to gain access to parent attention (I/HP). Conversely, if parent instructions paired with the same highly preferred toy were sufficiently aversive, then negative reinforcement should maintain Kyle's time allocation to the side of the room on which no instructions were given during his interaction with the highly preferred toy (alone/HP).

*Phase 4: Treatment probes.* For both children, the results of the functional analysis indicated that problem behavior was maintained by escape from parent task instructions. However, both children displayed increased compliance with instructions and decreased problem behavior when instructions were made with either a highly preferred activity (Susan) or a less preferred activity when that activity was paired with parent attention (Kyle). Given these outcomes, we selected a treatment procedure that made access to highly preferred activities and parent attention contingent on following parent instructions with activities that resulted in task avoidance during the functional analysis.

Parents were given instructions on treatment implementation and asked to conduct treatment sessions on a daily basis. Treatment for both children consisted of a variation of the interspersed request procedure described by Horner, Day, Sprague, O'Brien, and Heathfield (1991). In the Horner *et al.* study, the participants' aberrant behavior was reduced by interspersing easy tasks (i.e., tasks that had a high probability of completion without trainer assistance) within a series of hard tasks (i.e., tasks that had a low probability of completion without trainer assistance). In the current study, we used the results of the choice assessment to identify variables associated with compliance to parent instructions and noncompliance or escape from parent instructions. We evaluated



whether interspersing instructions that resulted in noncompliance or escape with activities associated with high levels of appropriate behavior increased compliance to parent instructions. In this procedure, the child was first given access to preferred toys and provided with continuous parent attention (play, social interaction) for 1 min. The parent then introduced an instruction from the functional analysis that was associated with noncompliance. If the child completed the task, the parent praised the child, allowed the child access to preferred activities for 1 min, and provided continuous attention. If the child refused to complete the task or engaged in problem behavior, the parent removed the preferred activities and ignored the child for 30 s. After 30 s, the instruction was repeated. These procedures continued until the child completed 10 tasks.

For Susan, the less preferred activity was an educational game that involved manipulating parent-selected game pieces. This activity was chosen because Susan never selected this game during the preference assessment and avoided parent instructions with this activity during the functional analysis and choice assessment. For Kyle, the less preferred activity consisted of tracing letters and numbers. Although Kyle typically selected crayon-and-paper activities during the preference assessment, he avoided following instructions to trace letters and numbers during the functional analysis and choice assessment.

Follow-up treatment probes were videotaped over a 10-month period for both Susan and Kyle to evaluate treatment effects. Initial treatment probes were conducted on a weekly basis for 2 months with Susan and for 3 months with Kyle. Subsequent treatment probes were conducted on a monthly basis for both children. Treatment probe sessions ranged in length from 2 min to 9 min ( $M = 6$  min) for Kyle and from 6 min to 9 min ( $M = 7$  min) for Susan.

## RESULTS

### *Phase 1: Preference Assessment*

The results of the preference assessment for each child are shown in Figure 1. The results of Susan's preference assessment showed some variability initially, but she played only with Legos® during three subsequent preference assessment probes that were conducted over a 2-month period. The results of Kyle's preference assessment showed that he played exclusively with crayon-and-paper activities during the initial preference assessment and during five of seven sessions during follow-up probes.

### *Phase 2: Functional Analysis*

The results of the functional analyses are shown in Figure 2. For Susan, problem behavior occurred primarily during the contingent escape condition. For Kyle, problem behavior occurred during both the contingent escape and the contingent attention conditions, but occurred with an increasing trend and at slightly higher percentages in the escape condition. Thus, problem behavior appeared to be maintained primarily by negative reinforcement (i.e., escape from demands) for both children, and, especially for Kyle, parent attention may also have functioned as an intermittent reinforcer.

### *Phase 3: Choice Assessment*

Figure 3 provides the results of Choice Conditions 1 and 2. The purpose of this analysis was to evaluate (a) whether positive or negative reinforcement maintained time allocation (Choice Condition 1) and (b) whether parent attention or access to preferred toys would maintain time allocation (Choice Condition 2). For Susan, time allocation to parent attention choice areas (attention/P and attention/N) ranged from 84% to 100% of intervals across sessions ( $M = 96\%$ ). These results showed that Susan consistently allocated her time to choice ar-

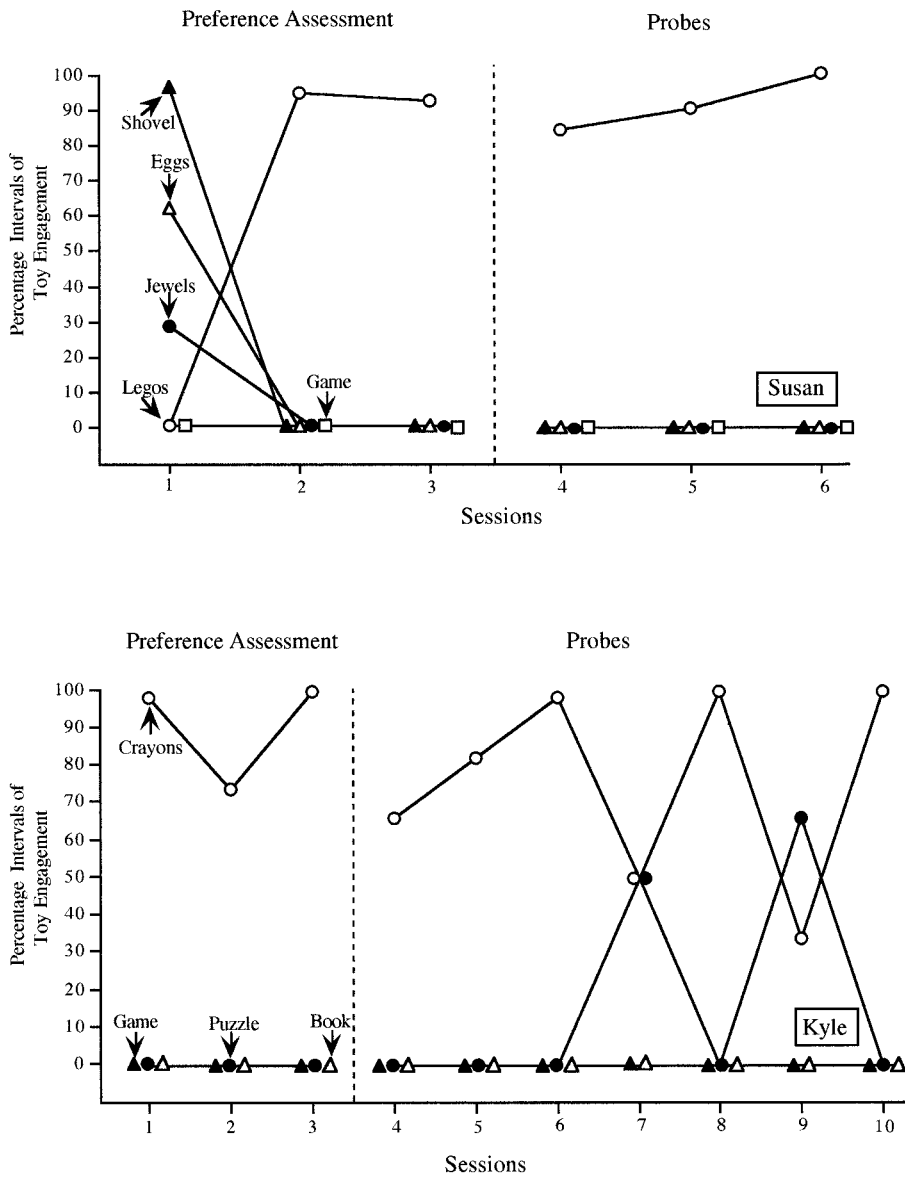


Figure 1. Susan's percentage of intervals with toy engagement during preference assessment (top left panel) and preference assessment probes (top right panel). Kyle's percentage of intervals with toy engagement during preference assessment (bottom left panel) and preference assessment probes (bottom right panel).

areas that included parent attention, irrespective of the availability of preferred toys in concurrent alone choice areas. For Kyle, overall time allocation in parent attention choice areas (attention/P and attention/N) ranged from 50% to 100% of intervals across sessions ( $M = 93%$ ). Similar to Su-

san, Kyle allocated his time to choice areas that included parent attention.

Figure 4 shows the results of Choice Conditions 3 and 4 for Susan. The purpose of this analysis was to evaluate time allocation when parent attention with instructions (I) were paired with either a highly preferred

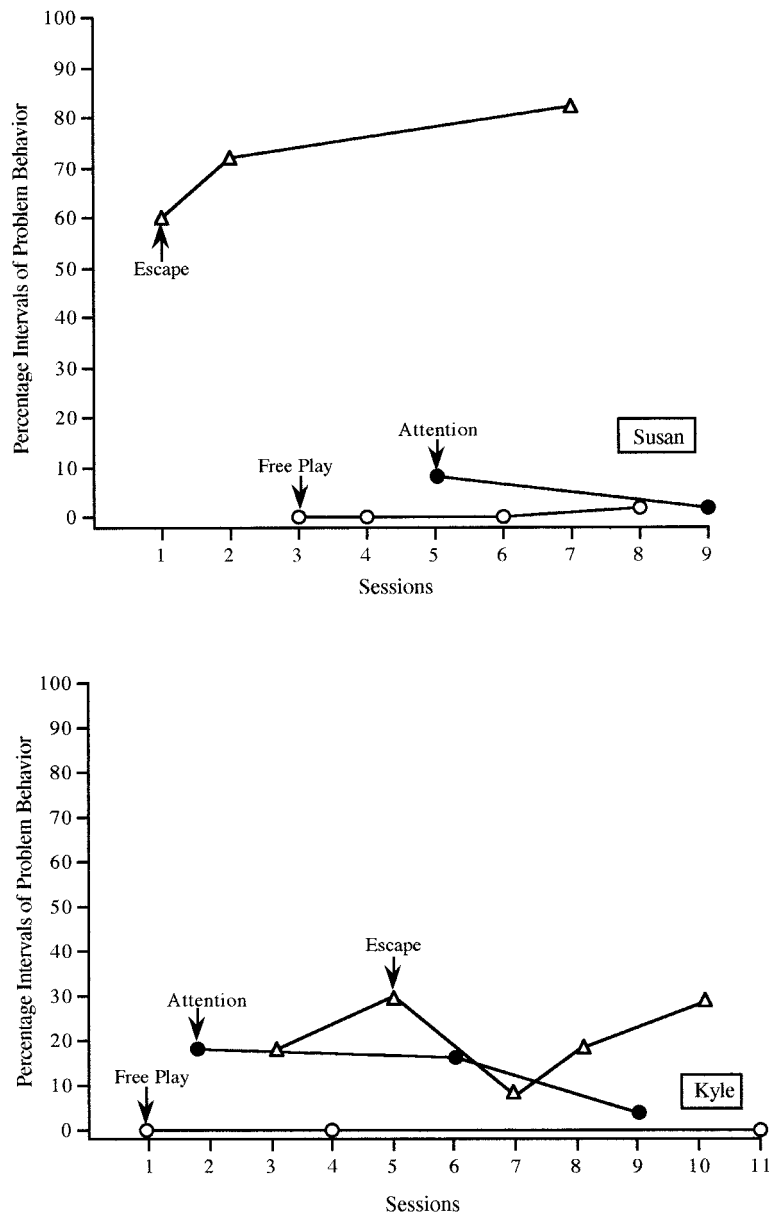


Figure 2. Susan's percentage of intervals with problem behavior during functional analysis (top panel). Kyle's percentage of intervals with problem behavior during functional analysis (bottom panel).

toy (HP) or less preferred toys (LP). During Choice Condition 3 (I/HP vs. alone/LP), Susan's time allocation was highest in the choice area that included parent attention with instructions and a highly preferred toy ( $M = 89\%$ ) and was associated with relatively high levels of task completion and relatively low levels of problem behavior. These

results suggested that positive reinforcement controlled both Susan's time allocation and compliance to parent instructions.

During Choice Condition 4 (I/LP vs. alone/HP), in which parent attention with instructions was paired with a less preferred toy (I/LP), Susan's time allocation to the choice area that included parent attention

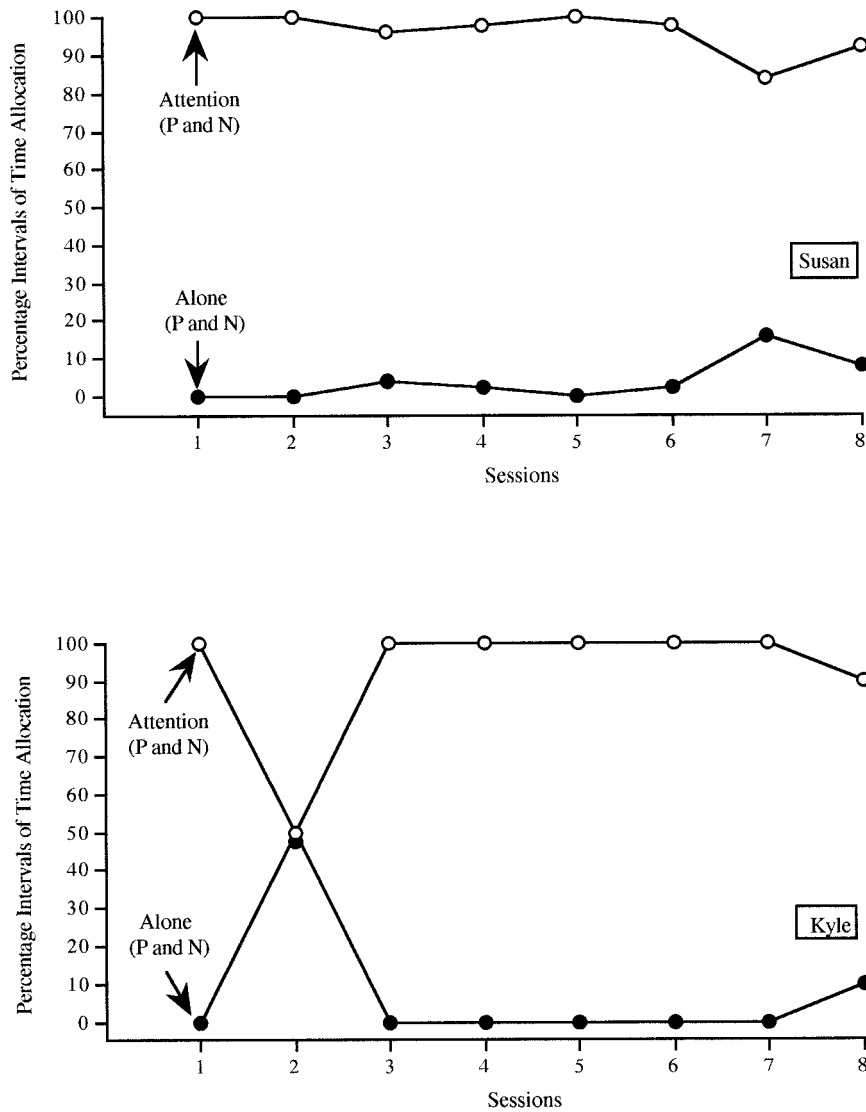


Figure 3. Susan's session-by-session percentage of intervals with time allocation to choice areas that included parent attention (attention/P and attention/N) and areas in which no attention was provided (alone/P and alone/N) during Choice Conditions 1 and 2 (top panel). Kyle's session-by-session percentage of intervals with time allocation to choice areas that included parent attention (attention/P and attention/N) and areas in which no attention was provided (alone/P and alone/N) during Choice Conditions 1 and 2 (bottom panel).

with instructions decreased ( $M = 43%$  across sessions; range, 0% to 94%), and task completion was either variable (Sessions 13 to 21) or at zero (Sessions 28 to 30). These results suggested that when parent attention and instructions were associated with a less preferred toy, Susan chose the area that allowed her to escape from instructions while gaining access to the highly preferred toy.

Figure 5 shows the results of Choice Conditions 3, 4, and 5 for Kyle. During Choice Condition 3 (I/HP vs. alone/LP), Kyle's time allocation was highest in the choice area that included parent attention with instructions and a highly preferred toy ( $M = 90%$ ), but levels of problem behavior and independent task completion were variable. During Choice Condition 4 (I/LP vs. alone/

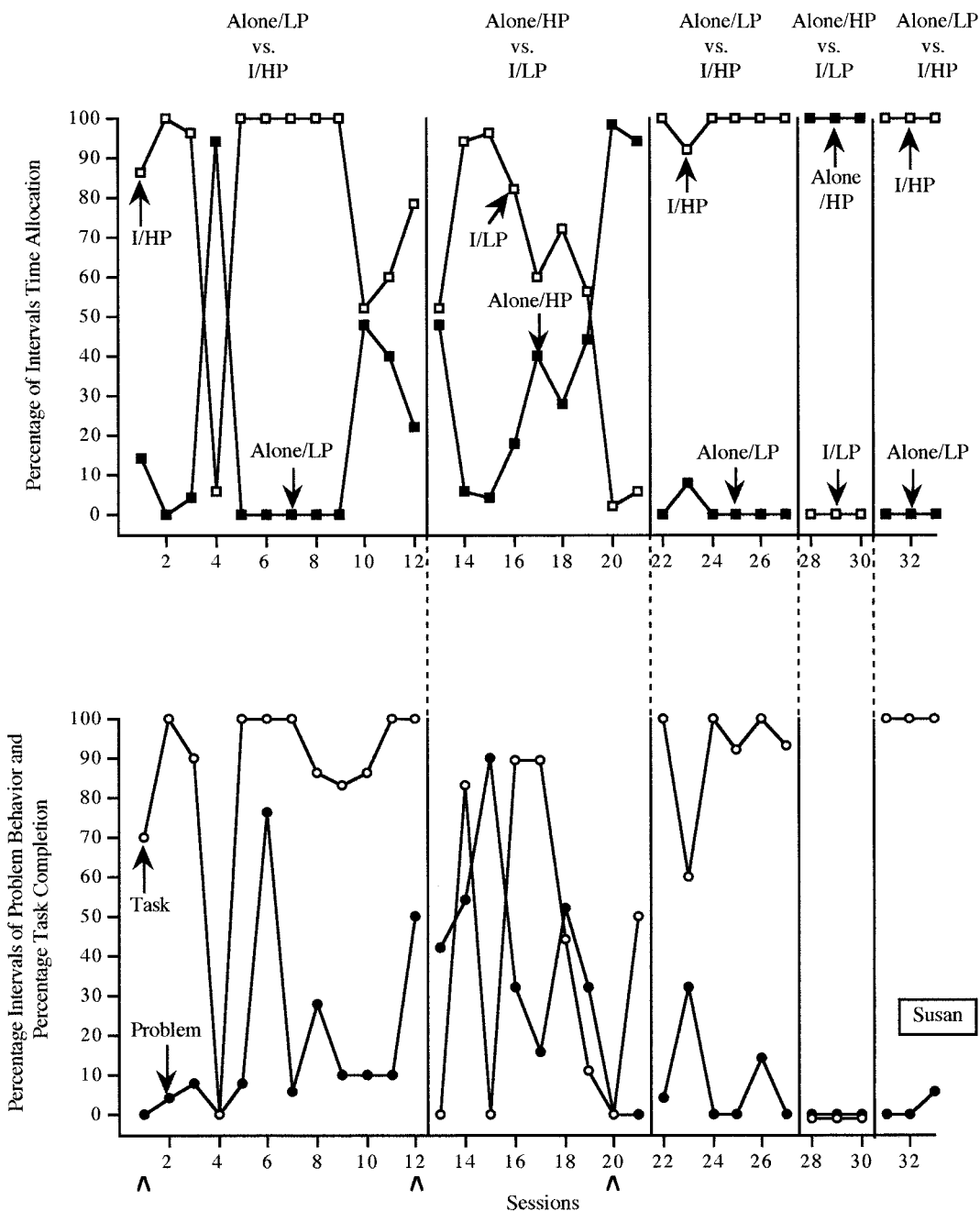


Figure 4. Susan's percentage of intervals with time allocation to choice areas that included attention with instructions (I/HP and I/LP) and areas in which no attention with instructions was provided (alone/HP and alone/LP) during Choice Conditions 3 and 4 (top panel). Susan's percentage of intervals with problem behavior and percentage of task completion during Choice Conditions 3 and 4 (bottom panel). I/HP = attention with instructions and highly preferred toy, I/LP = attention with instructions and less preferred toy, alone/LP = alone with less preferred toy, alone/HP = alone with highly preferred toy. Λ = preference assessment probe conducted.



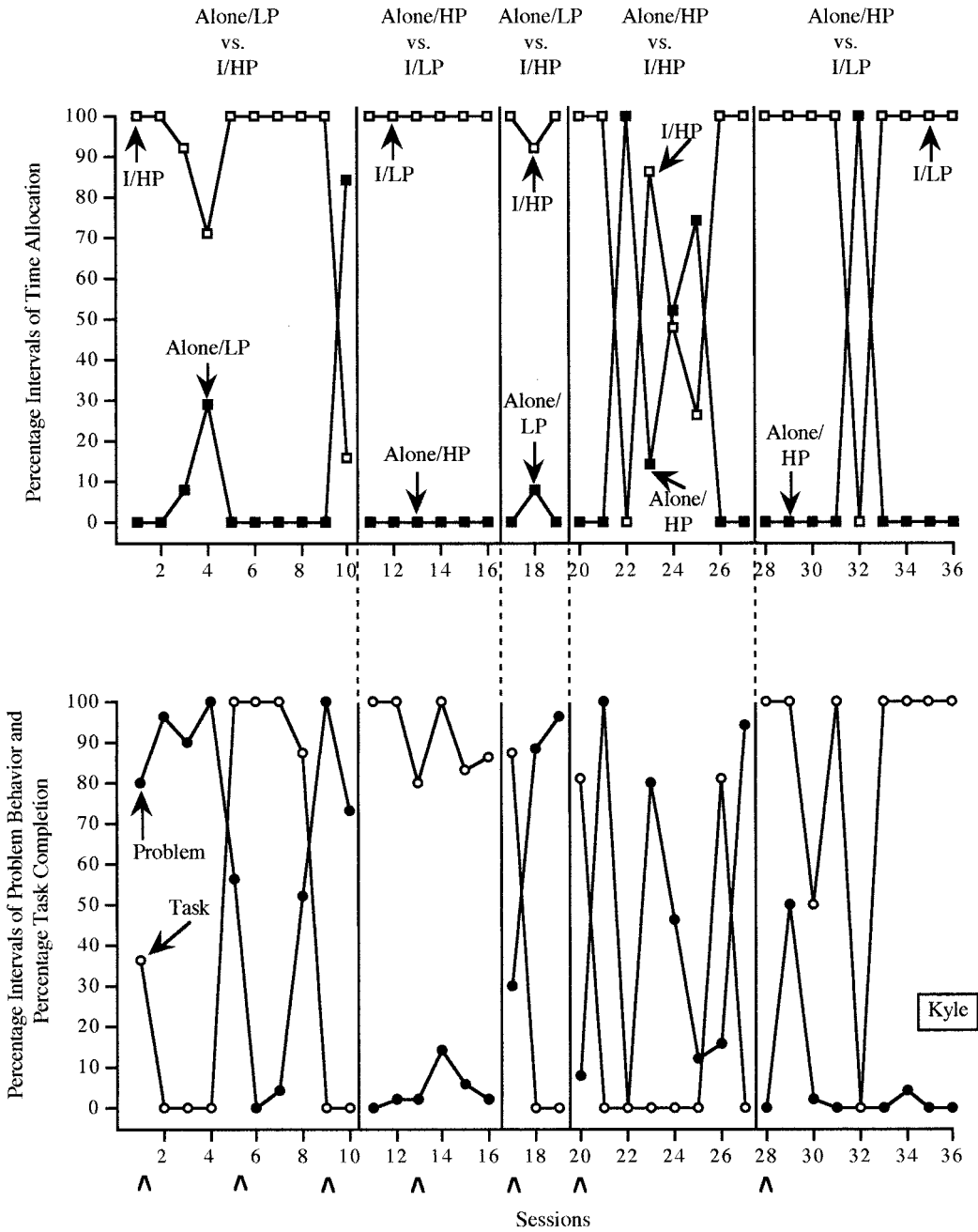


Figure 5. Kyle's percentage of intervals with time allocation to choice areas that included attention with instructions (I/HP and I/LP) and areas in which no attention with instructions was provided (alone/HP and alone/LP) during Choice Conditions 3, 4, and 5 (top panel). Kyle's percentage of intervals with problem behavior and percentage of task completion during Choice Conditions 3, 4, and 5 (bottom panel). I/HP = attention with instructions and highly preferred toy, I/LP = attention with instructions and less preferred toy, alone/LP = alone with less preferred toy, alone/HP = alone with highly preferred toy.  $\wedge$  = preference assessment probe conducted.

HP), Kyle's time allocation was highest in the choice area that included parent attention with instructions and a less preferred toy (I/LP). Time allocation in this choice area ranged from 0% to 100% ( $M = 93\%$ ). In contrast to Susan, Kyle's highest percentage of task completion and lowest percentage of problem behavior occurred during Choice Condition 4 (I/LP vs. alone/HP) in which parent attention with instructions was paired with a less preferred toy. Kyle's performance on task instructions and levels of problem behavior appeared to be influenced by the type of instruction associated with the designated toy. It appeared that Kyle avoided following instructions associated with a highly preferred toy because the toy was associated with specific behaviors (e.g., tracing letters in a certain order) that were reinforcing to him. With a less preferred toy, he was more likely to follow his parent's instructions.

During Choice Condition 5 (I/HP vs. alone/HP), Kyle's overall time allocation to the parent attention with instructions area (I/HP) decreased ( $M = 70\%$ ; range, 0% to 100%), and his percentages of task completion and problem behavior were again variable. Kyle's apparent aversion to following parent instructions with the highly preferred toy may explain his time allocation during Choice Condition 5, in which the highly preferred toy was available with and without parent instructions. In this condition, the opportunity to escape parent instructions while maintaining access to the highly preferred toy occasionally outweighed the positive reinforcement associated with parent attention.

#### *Phase 4: Treatment Probes*

Figure 6 shows the results of the follow-up treatment probes. For Susan, problem behavior decreased to 0% within three sessions and remained at 0% for the duration of the investigation (9 months). Her appropriate

social interactions increased during the treatment probes, and her independent task completion was 100% across all treatment probes. For Kyle, problem behavior decreased to 0% within three sessions and remained at 0% for the duration of the investigation (9 months). He also displayed an increase in social interactions with his parent during the treatment probes. His independent task completion remained at 100% across all treatment probes.

## DISCUSSION

In the current study, the choice assessment procedure enabled us to evaluate systematically the relative influence of combinations of both positive and negative reinforcement on children's behavior. For both children, specific choice options resulted in the child either (a) allocating time to choice areas that included parent attention (Choice Conditions 1 and 2), (b) consistently avoiding the parent and task instructions (Susan during Choice Condition 4), or (c) avoiding completion of the task while maintaining parent attention (Kyle during Choice Condition 3). The assessment procedure also identified specific concurrent choice options that resulted in compliance to parent instructions without the use of escape extinction procedures.

For the children who participated in this investigation, treatment could have been based solely on the results of the functional analysis (Iwata et al., 1982/1994). For both children, negative reinforcement appeared to maintain problem behavior during the functional analysis. However, as discussed by Iwata (1987), an analysis of behavior should consider the influence of positive reinforcement on the occurrence of escape-maintained behavior, because it is possible that the individual is avoiding one activity (demand) to engage in another. The influence of positive reinforcement during contingent

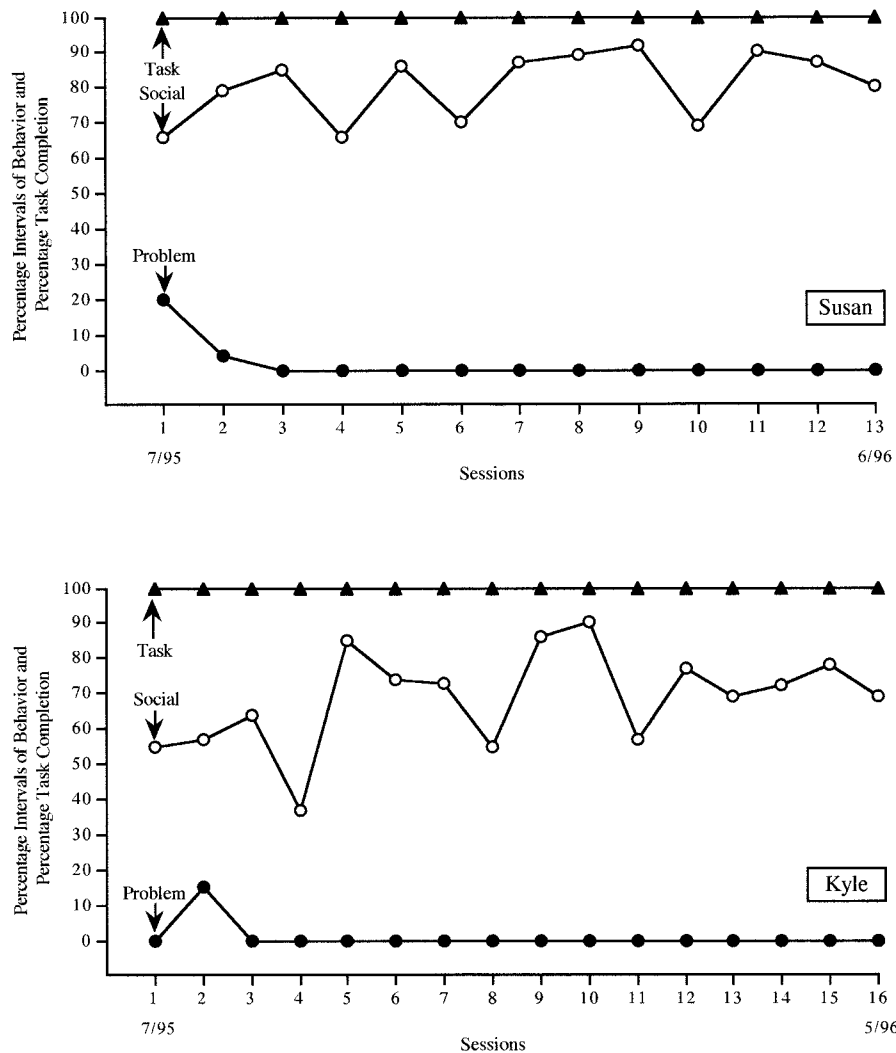


Figure 6. Susan's percentage of intervals with problem behavior and percentage of task completion during follow-up treatment probes (top panel). Kyle's percentage of intervals with problem behavior and percentage of task completion during follow-up treatment probes (bottom panel). Task = percentage of task instructions completed; Problem = percentage of intervals with problem behavior; Social = percentage of intervals with social interaction.

breaks for problem behavior was evaluated in a study by Zarcone *et al.* (1996). Results of that investigation showed that compliance was higher when breaks were paired with preferred stimuli as opposed to a break without access to preferred stimuli. Thus, compliance was most responsive to the combination of positive and negative reinforcement. The results of the choice assessment in the current investigation showed that the

positive reinforcement associated with access to parent attention, specific toys, or both, in a choice context could influence both time allocation and appropriate behaviors. In this respect, we viewed the choice assessment as a method of enhancing our functional analysis procedures by providing more specific information on the reinforcing effects of toys and parent attention.

For example, during Susan's choice assess-

ment, negative reinforcement emerged as a maintaining variable only during conditions in which parent attention was paired with less preferred toys. These results highlighted the importance of pairing parent attention with highly preferred toys within the treatment package to avoid inadvertently reinforcing Susan's escape from her parent. This approach appeared to be effective, because Susan showed increases in social interactions with her parent in addition to displaying decreases in problem behavior.

Kyle's functional analysis suggested that both escape from demands and parent attention maintained problem behavior. The results of the choice assessment indicated that compliance with instructions decreased when requests were associated with a highly preferred toy. We used this information in our treatment procedures by making continued access to both parent attention and highly preferred toys contingent on compliance. As his treatment probe results indicate, this approach was successful in reducing problem behavior and maintaining high levels of independent task completion throughout the investigation.

On a conceptual level, our results extend previous investigations on choice by examining the relative influence of positive reinforcement and negative reinforcement on children's behavior. As discussed by Neef et al. (1994), individual responding in choice situations is governed by the relativistic properties of response alternatives. As demonstrated by Peck et al. (1996), these properties may include dimensions of negative reinforcement (e.g., duration of break from demands) as well as dimensions of positive reinforcement (e.g., quality of reinforcer). In the current investigation, the children could control the amount of positive and negative reinforcement they received via their time allocation during each choice session. Thus, the choice assessment enabled us to identify more clearly the roles of positive and nega-

tive reinforcement across multiple behaviors (e.g., compliance, problem behavior).

As discussed by Peck et al. (1996), providing choices that bias responding for appropriate behavior may reduce reliance on escape extinction and punishment procedures within treatment packages. The results of the current choice assessment suggested that by providing choices that maximize the positive reinforcement available to the child, increases in compliance with parent instructions may occur without the use of escape extinction. However, these effects were limited to specific combinations of reinforcers. For example, although Susan complied with parent instructions with a highly preferred toy, she still avoided both parent contact and following parent instructions with less preferred toys. Kyle, on the other hand, was more likely to comply with parent instructions with a less preferred toy than with a highly preferred toy.

A number of limitations to the current study should be noted. First, duration of sessions (5 min) during the choice assessment limited our data collection to relatively small samples of behavior and, thus, may not be ideal for evaluating the effects of concurrent schedules. Second, treatment sessions were typically brief (6 to 7 min). On one occasion, Kyle chose to complete all of his work without a break, resulting in a treatment session of only 2 min. Third, we did not conduct a systematic evaluation of treatment integrity. Fourth, the tasks selected for treatment procedures did not correspond directly to parent reports of specific problem situations. The treatment procedures were intended to serve as a model that could be applied by parents across a variety of contexts. The extent to which the parents were satisfied with the treatment was assessed indirectly via a treatment acceptability checklist (Treatment Acceptability Rating Form—Revised; Reimers & Wacker, 1988) at the end of the study (see Wacker et al., 1998,

for an overall summary of these data). For example, in response to the question, "How acceptable do you find the treatment to be regarding your concerns about your child?" the parents rated the treatment on a scale of 1 = *not at all acceptable* to 7 = *very acceptable*. Parent ratings on this question were 6 for Kyle and 7 for Susan, which suggests that both parents were satisfied with the treatment procedures.

Although this investigation provides some preliminary evidence on the utility of using a choice assessment to evaluate the relative influence of positive and negative reinforcement on child behavior, additional work in this area is warranted. Previous studies (e.g., Neef *et al.*, 1994) have shown that multiple dimensions of positive reinforcement may interact to influence individual choices. Future investigations might use concurrent-operants procedures to evaluate the interaction of various dimensions of positive reinforcement with negative reinforcement. For example, evaluating combinations of negative reinforcement (e.g., varying amounts of break for compliance) with different dimensions (e.g., quality) of positive reinforcement may enable investigators to identify very specific treatment packages. Ultimately, a more thorough assessment of the specific properties of reinforcement that control appropriate behavior may emerge as a methodology that decreases the need for reductive treatment components.

## REFERENCES

- Browning, R. M. (1967). A same-subject design for simultaneous comparison of three reinforcement contingencies. *Behavioural Research and Therapy*, *5*, 237–243.
- Derby, K. M., Wacker, D. P., Andelman, M., Berg, W., Drew, J., Asmus, J., Prouty, A. M., & Laffey, P. (1995). Two measures of preference during forced-choice assessments. *Journal of Applied Behavior Analysis*, *28*, 345–346.
- Fisher, W. W., & Mazur, J. E. (1997). Basic and applied research on choice responding. *Journal of Applied Behavior Analysis*, *30*, 387–410.
- Fisher, W., Piazza, C. C., Bowman, L. G., Hagopian, L. P., Owens, J. C., & Slevin, I. (1992). A comparison of two approaches for identifying reinforcers for persons with severe and profound disabilities. *Journal of Applied Behavior Analysis*, *25*, 491–498.
- Fisher, W., Piazza, C., Cataldo, M., Harrell, R., Jefferson, G., & Conner, R. (1993). Functional communication training with and without extinction and punishment. *Journal of Applied Behavior Analysis*, *26*, 23–36.
- Goh, H., & Iwata, B. A. (1994). Behavioral persistence and variability during extinction of self-injury maintained by escape. *Journal of Applied Behavior Analysis*, *27*, 173–174.
- Horner, R. H., & Day, M. D. (1991). The effects of response efficiency on functionally equivalent competing behaviors. *Journal of Applied Behavior Analysis*, *24*, 719–732.
- Horner, R. H., Day, M. D., Sprague, J. R., O'Brien, M., & Heathfield, L. T. (1991). Interspersed requests: A nonaversive procedure for reducing aggression and self-injury during instruction. *Journal of Applied Behavior Analysis*, *24*, 265–278.
- Iwata, B. A. (1987). Negative reinforcement in applied behavior analysis: An emerging technology. *Journal of Applied Behavior Analysis*, *20*, 361–378.
- Iwata, B. A., Dorsey, M. F., Slifer, K. J., Bauman, K. E., & Richman, G. S. (1994). Toward a functional analysis of self-injury. *Journal of Applied Behavior Analysis*, *27*, 197–209. (Reprinted from *Analysis and Intervention in Developmental Disabilities*, *2*, 3–20, 1982)
- Iwata, B. A., Pace, G. M., Kalsher, M. J., Cowdery, G. E., & Cataldo, M. F. (1990). Experimental analysis and extinction of self-injurious escape behavior. *Journal of Applied Behavior Analysis*, *23*, 11–27.
- Lerman, D. C., & Iwata, B. A. (1996). Developing a technology for the use of operant extinction in clinical settings: An examination of basic and applied research. *Journal of Applied Behavior Analysis*, *29*, 345–382.
- Mace, F. C., Neef, N. A., Shade, D., & Mauro, B. C. (1994). Limited matching on concurrent-schedule reinforcement of academic behavior. *Journal of Applied Behavior Analysis*, *27*, 585–596.
- Neef, N. A., Mace, F. C., & Shade, D. (1993). Impulsivity in students with serious emotional disturbance: The interactive effects of reinforcer rate, delay, and quality. *Journal of Applied Behavior Analysis*, *26*, 37–52.
- Neef, N. A., Shade, D., & Miller, J. S. (1994). Assessing influential dimensions of reinforcers on choice in students with serious emotional disturbance. *Journal of Applied Behavior Analysis*, *27*, 575–583.
- Northup, J., George, T., Jones, K., Broussard, C., & Vollmer, T. R. (1996). A comparison of reinforcers



- er assessment methods: The utility of verbal and pictorial choice procedures. *Journal of Applied Behavior Analysis*, 29, 201–212.
- Pace, G. M., Ivancic, M. T., Edwards, G. L., Iwata, B. A., & Page, T. J. (1985). Assessment of stimulus preference and reinforcer value with profoundly retarded individuals. *Journal of Applied Behavior Analysis*, 18, 249–255.
- Peck, S. M., Wacker, D. P., Berg, W. K., Cooper, L. J., Brown, K. A., Richman, D., McComas, J. J., Frischmeyer, P., & Millard, T. (1996). Choice-making treatment of young children's severe behavior problems. *Journal of Applied Behavior Analysis*, 29, 263–290.
- Piazza, C. C., Fisher, W. W., Hagopian, L. P., Bowman, L. G., & Toole, L. (1996). Using a choice assessment to predict reinforcer effectiveness. *Journal of Applied Behavior Analysis*, 29, 1–9.
- Piazza, C. C., Fisher, W. W., Hanley, G. P., Remick, M. L., Contrucci, S. A., & Aitken, T. L. (1997). The use of positive and negative reinforcement in the treatment of escape-maintained destructive behavior. *Journal of Applied Behavior Analysis*, 30, 279–298.
- Reimers, T., & Wacker, D. (1988). Parents' ratings of the acceptability of behavioral treatment recommendations made in an outpatient clinic: A preliminary analysis of the influence of treatment effectiveness. *Behavioral Disorders*, 14, 7–15.
- Sigafoos, J., & Dempsey, R. (1992). Assessing choice making among children with multiple disabilities. *Journal of Applied Behavior Analysis*, 25, 747–755.
- Smith, R. G., Iwata, B. A., & Shore, B. A. (1995). Effects of subject- versus experimenter-selected reinforcers on the behavior of individuals with profound developmental disabilities. *Journal of Applied Behavior Analysis*, 28, 61–71.
- Wacker, D. P., & Berg, W. K. (1992). *Inducing reciprocal parent/child interactions*. Washington, DC: Department of Health and Human Services, National Institute of Child Health and Human Development.
- Wacker, D. P., Berg, W. K., Harding, J. W., Derby, K. M., Asmus, J. M., & Healy, M. D. (1998). Evaluation and long-term treatment of aberrant behavior displayed by young children with disabilities. *Journal of Developmental and Behavioral Pediatrics*, 19, 260–266.
- Wacker, D. P., Steege, M. W., Northup, J., Sasso, G., Berg, W., Reimers, T., Cooper, L., Cigrand, K., & Donn, L. (1990). A component analysis of functional communication training across three topographies of severe behavior problems. *Journal of Applied Behavior Analysis*, 23, 417–429.
- Windsor, J., Piche, L. M., & Locke, P. A. (1994). Preference testing: A comparison of two presentation methods. *Research in Developmental Disabilities*, 15, 439–455.
- Zarcone, J. R., Fisher, W. W., & Piazza, C. C. (1996). Analysis of free-time contingencies as positive versus negative reinforcement. *Journal of Applied Behavior Analysis*, 29, 247–250.

Received March 16, 1998

Initial editorial decision May 9, 1998

Final acceptance August 24, 1998

Action Editor, Patrick C. Friman

## STUDY QUESTIONS

1. What are some variables that influence choice behavior?
2. Why are concurrent-operant arrangements useful in assessing potential reinforcers? How might such procedures reduce the necessity of using extinction as a treatment for behavior problems?
3. What are the distinctive features of concurrent, multiple, and mixed schedules? Which type of schedule was used during the toy preference assessment?
4. Briefly describe the test conditions (attention and escape) of the functional analysis and the results obtained for the participants.
5. What reinforcement contingencies were somewhat confounded in the escape condition of the functional analysis? How might one separate the effects of these contingencies?

6. What variables were manipulated in the choice conditions, and which ones appeared to control each participant's responding?
7. Describe the procedures implemented during the treatment probes. How were these procedures related to results of the functional analysis and choice assessments?
8. How might one increase compliance with instructional tasks and decrease problem behavior maintained by attention without using extinction?

Questions prepared by Jana S. Lindberg and Michele D. Wallace, The University of Florida